FILTER STRIP (ACRE)

CODE 393A

MONTANA TECHNICAL GUIDE **SECTION IV**

DEFINITION

A strip or area of herbaceous vegetation situated between cropland, grazing land, or disturbed land (including forestland) and environmentally sensitive areas.

PURPOSE

- To reduce sediment, particulate organics, and sediment adsorbed contaminant loadings in runoff
- To reduce dissolved contaminant loadings in runoff
- To serve as Zone 3 of 391–Riparian Forest Buffer, **Field Office Technical (FOTG), Section IV, Practice Standards and Specifications.**
- To reduce sediment, particulate organics, and sediment adsorbed contaminant loadings in surface irrigation tailwater
- To restore, create or enhance herbaceous habitat for wildlife and beneficial insects.
- To maintain or enhance watershed functions and values
- To utilize excess nutrients found in runoff water and ground water
- To manage bacteria in runoff from livestock confinement areas.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies (1) in areas situated below cropland, grazing land, **livestock confinement areas,** or disturbed land (including forestland); (2) where sediment, particulate organic matter and/or dissolved contaminants may leave these areas and are entering environmentally sensitive areas; (3) in areas where permanent vegetative establishment is needed to enhance wildlife and beneficial insects, or maintain or enhance watershed function. This practice applies when planned as part of a conservation management system.

CRITERIA

General Criteria Applicable To All Purposes

Filter strips shall be designated as vegetated areas to treat runoff and are not part of the adjacent cropland rotation.

Overland flow entering the filter strip shall be primarily sheet flow. Concentrated flow shall be dispersed.

State listed noxious weeds will not be established in the filter strip and will be controlled if present.

Filter strip establishment shall comply with local, state and federal regulations.

Select plant species which are adapted to local soil and moisture conditions. Sod-forming species will normally reduce runoff most effectively. However, a mixture of sod-forming and bunch-forming species may be utilized where wildlife cover, food, and soil fertility are important. See TABLE 4 for species adaptation.

NOTE: This type of font **(AaBbCcDdEe 123..)** indicates NRCS National Standards.
This type of font (AaBbCcDdEe 123..) indicates Montana Supplement.

Additional Criteria To Reduce Sediment, Particulate Organics, and Sediment-Adsorbed Contaminant Loadings in Runoff

Filter strip flow length shall be determined based on field slope percent and length, and filter strip slope percent, erosion rate, amount and particle size distribution of sediment delivered to the filter strip, density and height of the filter strip vegetation, and runoff volume associated with erosion producing events. The minimum flow length **(width of filter strip***)* for this purpose shall be 20 feet. **Using TABLE 1 adjust filter strip width based on the field slope and texture above the strip.**

Filter strip location requirements:

a) The filter strip shall be located along the downslope edge of a field or disturbed area. To the extent practical it shall be placed on the approximate contour**. For best results,** variation in placement on the contour should not exceed a 0.5 percent longitudinal (perpendicular to the flow length) gradient.

b) The drainage area above the filter strip shall have greater than 1 percent but less than 10 percent slopes.

c) The ratio of the drainage area to the filter strip area shall be less than 70:1 in regions with RUSLE-R factor values 0–35, 60:1 in regions with RUSLE-R factor values 35–175, and 50:1 in regions with RUSLE-R factor values of more than 175.

d) The average annual sheet and rill erosion rate above the filter strip shall be less than 10 tons per acre per year.

The filter strip shall be established to permanent herbaceous vegetation consisting of a single species or a mixture of grasses, legumes and/or other forbs adapted to the soil, climate, and nutrients, chemicals, and practices used in the current management system. Species selected shall have stiff stems and a high stem density near the ground surface. Stem density shall be such that the stem spacing does not exceed one inch. Where fast establishment of cover is important annual ryegrass or **spring seeded small grain crops may be used to ensure adequate protection the first year of establishment. With the exception of spring seeded winter wheat, small grain crop should be destroyed by herbicide or clipped prior to seed head formation.**

TABLE 1. Minimum Width of Filter Strips Related To Slope and Soil Texture

SLOPE	MINIMUM FILTER STRIP WIDTH	SOIL TEXTURE* ADJUSTMENT (ft) A	B
0-3%	20 feet	+5	+5
4-9%	25 feet	+5	+10
10-15%	30 feet	+10	+15
15% +	40 feet	+15	+25

* A=FSL, SL, COSL, LVFS, LFS
B=CL, SC, SIC, CL, SICL, SCL, SI, L, SIL, VFSL

Additional Criteria To Reduce Dissolved Contaminants in Runoff

The criteria given in **"Additional Criteria To Reduce Sediment, Particulate Organics, and Sediment Adsorbed Contaminant Loadings in Runoff"** also apply to this purpose.

Filter strip flow length required to reduce dissolved contaminants in runoff shall be based on management objectives, contaminants of concern, and the volume of runoff from the filter strip's drainage area compared with the filter strip's area and infiltration capacity.

The flow length determined for this purpose shall be in addition to the flow length determined for reducing sediment, particulate organics, and sediment-adsorbed contaminant loadings in runoff. The minimum flow length (strip width) for this purpose shall be 30 feet. **Using TABLE 2 adjust filter strip width based on the field slope and soil texture.**

TABLE 2. Minimum Width of Filter Strips Related To Slope and Soil Texture

SLOPE	MINIMUM FILTER STRIP WIDTH	SOIL TEXTURE* ADJUSTMENT (ft) A	B
0-3%	30 feet	+5	+5
4-9%	35 feet	+5	+10
10-15%	40 feet	+10	+15
15% +	45 feet	+15	+25

* A=FSL, SL, COSL, LVFS, LFS
B=CL, SC, SIC, CL, SICL, SCL, SI, L, SIL, VFSL

Additional Criteria for Filter Strips for Trapping Sediment and Related Pollutants

These criteria apply to filter strips on cropland at the lower edge of fields, on fields, on pastures, or in manure spreading areas adjacent to streams, ponds, **wetlands,** and lakes, and above conservation practices such as terraces or diversions.

The length of flow through vigorous vegetation shall be at least 20 feet for slopes of less than one percent and installed on very permeable soils. The width shall be proportionately wider for steeper slopes and/or less permeable soils**. TABLE 1 illustrates the minimum filter strip widths in relation to associated slope and texture adjustment.**

Additional Criteria To Serve as Zone 3 of FOTG, Section IV, Practice Standard 391–Riparian Forest Buffer

Except for the location requirements, the criteria given in **"Additional Criteria To Reduce Sediment, Particulate Organics, and Sediment Adsorbed Contaminant Loadings in Runoff"** also apply to this purpose. **Use TABLE 1 to adjust filter strip width for slope and soil texture.**

If concentrated flows entering Zone 3 are greater than the filter strip's ability to disperse them, other means of dispersal, such as spreading devices, must be incorporated. **Refer to FOTG, Section IV, Practice Standard 391–Riparian Forest Buffer.**

Additional Criteria To Reduce Sediment, Particulate Organics, and Sediment Adsorbed Contaminant Loadings in Surface Irrigation Tailwater

Filter strip vegetation may be **perennial or** a small grain or other suitable annual with a plant spacing that does not exceed two inches. **With the exception of spring seeded winter wheat clip small grains prior to seed head formation.**

Filter strips shall be established early enough prior to the irrigation season so that the vegetation can withstand sediment deposition from the first irrigation. **When necessary, remove excess sediment deposits in filter to ensure proper functioning.**

The flow length (strip width) shall be based on management objectives. **Use TABLE 1 to design appropriate filter strip width.**

Additional Criteria To Restore, Create, or Enhance Herbaceous Habitat for Wildlife and Beneficial Insects

If this purpose is intended in combination with one or more of the previous purposes, then the minimum criteria for the previous purpose(s) must be met. Additional filter strip flow length devoted to this purpose must be added to the **flow** length required for the other purpose(s).

Any addition to the flow length for wildlife or beneficial insects shall be added to the downhill slope of the filter strip. Vegetation to enhance wildlife may be added to that portion of the filter strip devoted to other purposes to the extent they do not detract from its primary functions.

Plant species selected for this purpose shall be for permanent vegetation adapted to the wildlife or beneficial insect population(s) targeted.

If this is the only purpose, filter strip width and length shall be based on requirements of the targeted wildlife or insects. Density of the vegetative stand established for this purpose shall consider targeted wildlife habitat requirements and encourage plant diversity. Dispersed woody vegetation may be used to the extent it does not interfere with herbaceous vegetative growth, or operation and maintenance of the filter strip.

The filter strip shall not be mowed during the nesting season of the target wildlife.

Livestock and vehicular traffic in the filter strip shall be excluded during the nesting season of the target species.

Additional Criteria To Maintain or Enhance Watershed Functions and Values

Filter strips shall be strategically located to enhance connectivity of corridors and non-cultivated patches of vegetation within the watershed.

Filter strips should be strategically located to enhance aesthetics of the watershed.

Plant species selected for this purpose shall be for establishment of permanent vegetation.

Additional Criteria To Utilize Excess Nutrients Found in Runoff Water and Ground Water

The criteria given in "Additional Criteria To Reduce Dissolved Contaminants in Runoff" also apply to this purpose.

Filter strips should be strategically located to intercept runoff and subsurface flow so that excess nutrients can be utilized by plant species. Select plant species for the intended purpose. Where excess nutrients in runoff are a concern, sod-forming grasses should be predominant. Where subsurface flows are a concern, deep-rooted species should be included in the mixture (i.e., alfalfa).

Additional Criteria To Manage Runoff and Bacteria From Llivestock Confinement Areas

Total removal of coliform bacteria may not occur unless filter strip is designed to eliminate flow past the strip itself. Additional structures may be needed to eliminate contamination to a water body including diversions, a settling basin, or dike.

Filter strips shall be installed on the contour as much as practical with no more than 0.5 percent longitudinal gradient. Filter strip flow length (width) will be at least 75 feet. See TABLE 3 to adjust width for slope and soil texture.

Select vegetative species that will remain upright during flows. Select plant species that are adapted to local soil and moisture conditions.

TABLE 3. Minimum Width of Filter Strips Related To Slope and Soil Texture

SLOPE	MINIMUM FILTER STRIP WIDTH	SOIL TEXTURE* ADJUSTMENT (ft) A	B
0-3%	75 feet	+15	+25
4-9%	100 feet	+25	+40
10-15%	150 feet	+50	+75
15% +	200 feet	+75	+100

* A=FSL, SL, COSL, LVFS, LFS
B=CL, SC, SIC, CL, SICL, SCL, SI, L, SIL, VFSL

CONSIDERATIONS

Filter strips should be strategically located to reduce runoff, and increase infiltration and ground water recharge throughout the watershed.

Filter strips for the single purposes of wildlife/beneficial insect habitat or to enhance watershed function should be strategically located to intercept contaminants thereby enhancing the water quality of the watershed.

To avoid damage to the filter strip consider using vegetation that is somewhat tolerant to herbicides used in the upslope crop rotation.

Consider using this practice to enhance the conservation of declining species of wildlife, including those that are threatened or endangered.

Consider using this practice to protect National Register listed or eligible (significant) archaeological and traditional cultural properties from potential damaging contaminants.

Filter strip size should be adjusted to a greater flow length to accommodate harvest and maintenance equipment.

Filter strips by themselves may not eliminate runoff. Complimentary practices may be necessary especially where receiving waters must be protected.

PLANS AND SPECIFICATIONS

Based on this standard, plans and specifications shall be prepared for each specific field site where a filter strip will be installed. A plan includes information about the location, construction sequence, vegetation establishment, and management and maintenance requirements.

Specifications will include:

a) Length, width, and slope of the filter strip to accomplish the planned purpose (length refers to flow length across the filter strip).

b) Species selection and seeding or sprigging rates to accomplish the planned purpose

c) Planting dates, care, and handling of the seed to ensure that planted materials have an acceptable rate of survival

d) A statement that only viable, high quality, and regionally adapted seed will be used

e) Site preparation sufficient to establish and grow selected species

f) The Montana Filter Strip specification sheet is required and must be placed in the field office case file.

OPERATION AND MAINTENANCE

For the purposes of filtering contaminants, permanent filter strip vegetative plantings should be harvested as appropriate to encourage dense growth, maintain an upright growth habit, and remove nutrients and other contaminants that are contained in the plant tissue.

Control undesired weed species, especially state-listed noxious weeds.

Prescribed burning may be used to manage and maintain the filter strip when an approved burn plan has been developed.

Inspect the filter strip after storm events and repair any gullies that have formed, remove unevenly deposited sediment accumulation that will disrupt sheet flow, reseed disturbed areas, and take other measures to prevent concentrated flow through the filter strip.

Apply supplemental nutrients as needed to maintain the desired species composition and stand density of the filter strip.

To maintain or restore the filter strip's function, periodically regrade the filter strip area when sediment deposition at the filter strip-field interface jeopardizes its function, and then reestablish the filter strip vegetation, if needed. If wildlife habitat is a purpose, destruction of vegetation within the portion of the strip devoted to that purpose should be minimized by regrading only to the extent needed to remove sediment and fill concentrated flow areas.

Fertilizer application may be necessary to adequately establish grass/legumes especially where topsoil has been removed and less fertile subsoil is the medium seeds are being planted into. Fertilizer should be placed near the seed. Nitrogen rates must be limited to prevent damage to the seedling. Broadcasting of fertilizer is not highly recommended due to the fact that a high percentage of broadcast fertilizer is used by weeds which become more competitive with the developing grass or legume. When placing fertilizer near the seed nutrients should be limited to: nitrogen—40 pounds per acre (NO_3-N); phosphorus—20 pounds per acre (P_2O_5). Seeding depth is vitally important for proper germination and a successful stand.

If weed control is needed appropriate pesticides must be used. Use and application of all pesticides must be in accordance with Federal and Montana State regulations and label directions. Pesticide recommendations must be made according to the *Montana Weed Management Handbook***.**

TABLE 4. Grass Species Characteristics and Adaptability

SPECIES	MOISTURE RANGE OF ADAPTABILITY (IN)	SOIL PROTECTION AND COVER [1/]		
		RIPARIAN AREAS	CRITICAL AREAS	NITROGEN UPTAKE [2/]
Bromegrass, Smooth	12+	Y	Y	H
Bromegrass, Mountain	14-20	N	Y	M
Canarygrass, Reed	15+	Y	N	H
Foxtail, Creeping	18+	Y	N	H
Needlegrass, Green	12-18	N	Y	L
Orchardgrass	15+	N	Y	M
Timothy	15+	N	Y	M
Wheatgrass, Crested	10-18	N	Y	H
Wheatgrass, Intermediate	13-22	N	Y	H
Wheatgrass, Pubescent	12-20	N	Y	H
Wheatgrass, Siberian	10-18	N	Y	L
Wheatgrass, Slender	12-20	N	Y	M
Wheatgrass, Thickspike	10-18	Y	Y	L
Wheatgrass, Streambank	8-18	Y	Y	L
Alfalfa	12+	N	Y	M
Clover, Alsike	16+	N	Y	M
Clover, Ladino	16+	N	Y	M
Clover, White	14+	N	Y	M
Sweetclover	10+	N	Y	L
Trefoil, Birdsfoot	14+	N	Y	L
Milkvetch, Cicer	14+	N	Y	M
Fescue, Hard	14-20	N	Y	M
Grama, Blue	10-18	N	Y	L
Ricegrass, Indian	10-18	N	Y	L
Needle and Thread	10-18	N	Y	L
Saltgrass, Inland	15+	Y	Y	L

[1/] Y = well adapted; N = not adapted

[2/] Based on relative N+, use efficiency assuming adequate moisture is available for plant growth

REFERENCES

Fertilizer Guidelines for Montana, Montana State University, Extension Service Bulletin EB 104, February 1992.

Montana–Utah–Wyoming Weed Management Handbook 1999-2000, Extension Service of Montana State University, Utah State University, and University of Wyoming.

W.O. Thom and R. L. Blevins. Conservation Tillage and Filter Strips Trap Potential Water Contaminants, Extension Service, University of Kentucky, 1996.

T.A. Dillaha, J.H. Sherrard, D. Lee, S. Mostaghimi, V.O. Shanholtz. Evaluation of Vegetative Filter Strips as a Best Management Practice for Feed Lots, Journal WPCF, Volume 60, Number 7, July 1988.

J.S. Jacobsen, S.H.Lorbeer, H.A.R. Houlton, and G.R.Carlson. *Nitrogen Fertilization of Dryland Grasses in the Northern Great Plains*, 1985, J. Range Management 49:340–345.

USDA–Natural Resources Conservation Service, Field Office Technical Guide, Section IV, Practice Standard 512–Pasture/Hayland Planting, July 1989.

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J.J. Fajardo, J.W. Bauder. Managing Nitrate and Bacteria in Runoff From Livestock Confinement Areas With Vegetative Filter Strips. Montana State University, May 2000.

R.A. Fasching, J.W. Bauder. Non-point Source Pollution Control Using Dryland Vegetative Filter Strips. Montana State University, April 1999.

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service.

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

FILTER STRIP (ACRE)

CODE 393A

MONTANA CONSERVATION PRACTICE SPECIFICATION

(LANDOWNER/OPERATOR)	DATE	LOCATION, FIELD NO., OR CONTRACT ITEM NO.

DEFINITION: A strip or area of herbaceous vegetation situated between cropland, grazing land, or disturbed land (including forestland) and environmentally sensitive areas.

PURPOSE:

- To reduce sediment, particulate organics, and sediment adsorbed contaminant loadings in runoff
- To reduce dissolved contaminant loadings in runoff
- To serve as Zone 3 of an FOTG, Section IV, Practice Standard 391–Riparian Forest Buffer
- To reduce sediment, particulate organics, and sediment adsorbed contaminant loadings in surface irrigation tailwater
- To restore, create or enhance herbaceous habitat for wildlife and beneficial insects
- To maintain or enhance watershed functions and values
- To utilize excess nutrients found in runoff water and ground water
- To manage bacteria in runoff from livestock confinement areas.

SECONDARY BENEFITS: Forage—on farm use or cash crop

- Field borders
- Turn rows and headlands
- Access
- Aesthetics
- Wildlife habitat

WHERE USED: At the lower edge of crop fields or in conjunction with other conservation practices.

- On fields along streams, ponds, lakes, and drainageways
- As part of a riparian forest buffer system
- Where there is sheet or uniform shallow flow (avoid concentrated flow)
- As part of an agricultural waste management system
- In conjunction with conservation practices on the contributing area to reduce contamination
- On slopes less than 10 percent.

CONSERVATION MANAGEMENT SYSTEM: Filter strips are normally established as part of a conservation management system to address the soil, water, air, plant, animal, and human needs as related to the owner's goals and objectives. It is important to consider the conservation crop rotation, nutrient and pest management, crop residue management, agricultural waste utilization, and other supportive conservation practices, when designing a filter strip. Filter strips can also provide forage production and improve farm aesthetics. They are most effective in providing conservation benefits when used in combination with other agronomic or structural practices.

WILDLIFE: Filter strips can enhance wildlife objectives depending on the vegetative species used and management practiced. Consider using species that can provide food and cover for important wildlife. Delay mowing of filter area until after nesting season.

FILTER STRIP SPECIFICATIONS: Filter Strips will be planted to sod-forming herbaceous vegetation, or a combination of sod-forming vegetation and shrubs and/or trees. When necessary the site will be to provide proper cross slope gradient to reduce water flow rates through the strip to reduce erosion through the filter and allowing sediment to settle out.

Seeding shall be completed between October 15 and May 15 unless irrigated. If filter strip is to be irrigated the planting can be extended to August 1. Where there is potential for flooding planting should be completed in spring after high water. Seedbed should be firm, clod and weed-free. Seeding may be made into crop stubble that is free of weeds. Species selected must be adapted to the site and appropriate for concerns of soil protection and cover. Plant seed at ½-inch for small seed species to a maximum of 1-inch for large seed species.

Fertilization may be completed to facilitate adequate vegetative growth where site has been graded and sub-soil is exposed. Application of fertilizer will be made after spring high water. Fertilizer rates should be 10 pounds Nitrogen (N), 10 pounds Phosphorus (P), and 10 pounds of Potassium (K). Broadcasting fertilizer should be avoided; rather, banding is preferred to minimize potential water pollution.

PURPOSE (CHECK ALL THAT APPLY)	
❑ SEDIMENT REDUCTION	❑ WASTE FILTRATION
❑ WATER INFILTRATION	❑ OTHER (SPECIFY)

FILTER STRIP LAYOUT	FILTER STRIP 1	FILTER STRIP 2	FILTER STRIP 3
Strip Width (ft)			
Strip Length (ft)			
Area of Filter Strip (ac)			
Slope (%)			
Veg. Species PLS: 1			
2			
3			
4			
Seeding Rate (PLS/acres)			
Fertilizer: N (lbs./acre)			
P_2O_5 (lbs./acre)			
K_2O (lbs./acre)			

PLANTING METHOD(S)

Drill grass and/or legume mixture uniformly at _____lbs. PLS/ac. Seeding will be completed perpendicular to slope. If necessary, mulch newly seeded area with _____ tons per acre of mulch material. A nurse crop or companion crop may be seeded to facilitate seeding and establishment at the rate of _____ lbs./acre. Crop must be clipped or harvested prior to development of seed.

OPERATION AND MAINTENANCE OF FILTER STRIPS

Maintain the original width and depth of the grass area. Regularly remove debris and excess sediment from filter area. Harvest, mow, clip, reseed, and fertilize as necessary to maintain vigorously growing vegetation. Inspect the filter strip periodically and make repairs where rills or small channels